Can Online Learning Bend the Higher Education Cost Curve?

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ABSTRACT

We examine whether online learning technologies have led to lower prices in higher education. Using data from the Integrated Postsecondary Education Data System, we show that online education is concentrated in large for-profit chains and less-selective public institutions. Colleges with a higher share of online students charge lower tuition prices. We present evidence that real and relative prices for full-time undergraduate online education declined from 2006 to 2013. Although the pattern of results suggests some hope that online technology can "bend the cost curve" in higher education, the impact of online learning on education quality remains uncertain.

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The earnings premium associated with additional education in the United States has risen markedly since 1980, suggesting that the supply of educated labor has not kept pace with demand (e.g., Goldin and Katz 2008). Yet the status of U.S. higher education funding is a key impediment to growing the supply of skills. Inflation-adjusted state appropriations for higher education have been stagnant since 1990 and have declined by 16 percent since 2007 (Baum and Ma 2014). Moreover, since education is a relatively labor-intensive industry, costs per student have risen faster than inflation and are likely to do so in the future (Baum, Kurose and McPherson 2013; Baumol and Bowen 1966). These financial pressures have lent urgency to the search for innovations that can "bend the cost curve" in higher education (Bowen et al. 2014).

Online learning technologies are regarded by most observers as the best hope for cost-saving innovations in higher education, with the primary channel being reduced labor costs through larger class size and less face-to-face interaction (Bowen 2012). Much research on the use of online technology in the classroom has focused on its potential for "disruptive innovation" in higher education, from superstar professors teaching elaborate courses developed by teams, to Massively Open Online Courses (MOOCs) offering top notch instruction to students worldwide (Christensen and Eyring 2011; Cowen and Tabarrok 2014).

In this paper we study whether online education can "bend the cost curve" in traditional higher education. We focus on degree-seeking undergraduates attending open access and less-selective postsecondary institutions, a group that accounted for about 59 percent of all U.S. postsecondary enrollments in 2013 based on data from the Integrated Postsecondary Education Data System (IPEDS) of the U.S. Department of Education. This tabulation does not include MOOCs and other non-degree programs that are difficult to track in the IPED**S**. Few degree-seeking students attend selective institutions through online programs. Cost pressures from

public funding cuts are most important for non-selective postsecondary institutions offering standard college coursework in a fee-for-service model (Hoxby 2014).

Using the IPEDS, we first document the extent of online education among U.S. degree-seeking undergraduates and how it varies by school sector and selectivity. We then ask whether schools with higher shares of students enrolled in online programs charge lower prices, controlling for detailed institutional characteristics and for geographic market and institution fixed effects. Finally, we compare the trend in tuition prices for online education to tuition prices in more traditional, non-selective postsecondary institutions. Overall, we find that institutions with more online students charge lower prices. However, the impact of online technology on the quality of education remains uncertain. Thus, one needs to be cautious before concluding that lower costs and prices in online programs will raise the *productivity* of U.S. higher education.

I. Background on Online Education in the United States

The growth of distance education was potentially limited by the 50 percent rule of the Higher Education Act (HEA) of 1992, under which schools offering more than 50 percent of their courses through distance education were not eligible to distribute Title IV student financial aid. Distance education from the early twentieth century took the form of correspondence courses administered by mail. Online higher education emerged in the 1990s with the Internet. The 1998 HEA created the Distance Education Demonstration Program (DEDP), granting waivers from the 50 percent rule to selected institutions including large for-profits such as the University of Phoenix. In 2006 the U.S. Department of Education discontinued the 50 percent rule thereby allowing "online only" postsecondary institutions to flourish (Deming, Goldin and

Katz 2012 provide more details). The share of bachelor's degrees awarded by "online only" institutions grew from 0.5 percent in 2000 to over 6 percent in 2012 (Deming et al. 2014).

Table 1 presents descriptive statistics on online enrollment by sector and selectivity.[1] In 2013, 11.1 percent of all U.S. undergraduate, degree-seeking students were enrolled in programs in which all instructional content was delivered online. More than one in four undergraduates in 2013 took at least one course online. Online education is concentrated among less-selective institutions. Only 1.3 percent of students in selective institutions were enrolled in fully online programs. Large for-profit "chains" such as the University of Phoenix, DeVry, and Kaplan enrolled more than half of all their students in programs operating exclusively online. For-profit "chains" accounted for about 32 percent of enrollment in fully online programs.

Combining online and traditional classroom instruction is most common in the non-selective public sector, where nearly 20 percent of students took at least one (but not all) courses online in 2013. This category most likely represents a variety of approaches to online education, from hybrid designs (i.e., reduced lecture time or "flipped" classrooms) to students enrolling in some fully online courses and some traditional courses.

Non-selective two- and four-year public institutions enrolled only 8.5 percent of students in fully online programs. Moreover, most of these students resided in the same state as the institution despite being enrolled online (column 5). The pattern suggests some reliance on the physical campus infrastructure (online students might come to campus for the exam or to receive help), although it might also reflect differential pricing for in-state students.[2] Out-of-state enrollment is far more common in the private not-for-profit and for-profit sectors (column 6).

[1] IPEDS has collected online enrollment data at the campus level since 2012.
[2] The IPEDS survey specifies that "requirements for coming to campus for orientation, testing or academic support services do not exclude a course from being classified as distance education."

The market for online education is rapidly becoming a national one, but it is not yet global. Only about 1 percent of all enrollment (just 1,800 students) in fully online programs came from outside the United States in 2013, but this situation may be changing rapidly. At least three large flagship public universities (Penn State, Colorado State and Arizona State) recently opened "global" campuses that operate exclusively online and are available to students worldwide.

The IPEDS, regrettably, does not contain school-level information on the demographic characteristics of students who are enrolled in online education. However, we can learn about aggregate demographic characteristics of students in online programs using the 2011/2012 National Postsecondary Student Aid Study (NPSAS), a nationally representative cross-section of institutions and students. The NPSAS data show that online students are older, have lower levels of parental education, are more likely to be single parents themselves, and are more likely to be working full-time while enrolled in school than are other college students.[3]

II. Online Education and Prices

To study the impact of online education on prices, we regress tuition and fees, from the IPEDS, on the share of students enrolled in "all" and "some" distance education for U.S. undergraduate institutions in 2012 and 2013, controlling for a variety of campus-level covariates such as sector, urbanicity, and measures of selectivity. The results are presented in Table 2. Column 1 reports estimates for public institutions, and column 4 reports results for for-profit and private not-for-profit institutions combined.[4] Columns 2 and 5 add geographic market fixed

[3] All calculations were performed on 2011/12 NPSAS data, using the PowerStats application (http://nces.ed.gov/datalab/powerstats/default.aspx).

[4] Few not-for-profits have multiple campus branches and we pool them with for-profits to increase power and conserve space. The results are highly similar when we estimate separate results by sector.

effects, which may help adjust for differences in costs and student demand across locations.

A major concern in interpreting the results in Table 2 is that differences in price are correlated both with the share of students enrolled online and with unobserved differences in quality. This issue is apparent in the descriptive statistics in Table 1, where selective institutions are far less likely to have students enrolled in online coursework. To address the concern, we first control directly for indicators of selectivity in all the results reported in Table 2. In addition, our preferred specification (columns 3 and 6) controls for institution-by-year fixed effects.[5]

The estimates in columns (3) and (6) exploit price and online enrollment differences across institutions with multiple campuses. For example, Penn State World Campus (where 98 percent of students are fully online) charged $13,466 in 2013, compared with $14,525 at a regional campus such as Penn State, Harrisburg and $17,332 at the flagship Penn State campus in State College. Kaplan University, Davenport IA (with more than 99 percent of students taking all courses online) charged $14,162 in tuition in 2013, compared with $15,659 at the Cedar Falls IA branch (having 35 percent of students fully online).

We find modest evidence of lower prices for schools with higher shares of students enrolled online. The results are most robust for the public sector, where a 10 percent (about 1 standard deviation) increase in the share of students taking all courses online is associated with a decline in prices of about 1.4 percent (column 3).

[5] Our geographic unit is the Core Based Statistical Area (CBSA), but results are similar using Combined Statistical Area (CSA) or county fixed effects. IPEDS collects data (e.g., tuition and fees) at the campus level. We group institutions by the first six digits of the eight-digit Office of Postsecondary Education (OPE) ID, with the last 2 digits unique to each campus. Although our main outcome is published tuition and fees for full-time students, our results are robust to using the per-credit-hour price (when available).

Columns 4 and 5 show a statistically significant impact of online enrollment on price in the not-for-profit and for-profit sectors of around 1.5 percent for a 10 percent increase in the online share. But there is no detectable impact of the online enrollment share on price for private institutions when controlling for institution-by-year fixed effects (column 6). The IPEDS data indicate that many large for-profits "chains" charge a single price across multiple campus branches. As seen in Table 1, more than half of students in for-profit chains are enrolled exclusively online, and only 13 percent of those students reside in the same state as the campus's physical location. For-profit chains appear to operate in a national market for online students, and national competition may limit their ability to charge different prices across campuses.

Although online enrollment data is only available from IPEDS since 2012, it is possible to look at trends in prices for campuses that were "online only" prior to 2012. We define "online" campuses as those where more than 50 percent of students were taking all their courses online in 2012.[6] Figure 1 examines the time trend in tuition at online institutions. We compare prices at online schools to schools where more than 50 percent of students take courses in-person. The 50 percent rule ended in 2006, opening up the online education market to additional competitors. From 2006 to 2013, the enrollment-weighted median price of a full-time undergraduate online education declined by 34 percent. Over the same period, the price of a traditional education at a large for-profit or not-for-profit school dropped by about 8 percent, and tuition at all non-selective four-year public institutions *increased* by 9.2 percent.[7]

[6] The time trend in Figure 1 is very similar when we define campuses as online if no more than 33 percent of the school's students are from one U.S. state, as in Deming, Goldin and Katz (2012).
[7] The three public flagships (Penn State, Arizona State and Colorado State) that opened "global" online campuses charged prices ($13,735, $8,184 and $8,800 respectively, all reported in 2014 dollars) that hew closely to the 2013 average for for-profit and not-for-profit online schools ($11,923).

III. Conclusion

We find some evidence that colleges are charging lower prices for online coursework, suggesting that advances in online learning technology might be able to "bend the cost curve" in higher education. There are two main caveats to our results.

First, it is possible that the quality of education suffers when more content is delivered online. An initial randomized trial of a college statistics course found no difference in student achievement in online versus in-person course sections (Bowen et al. 2014), but two recent studies have found negative impacts of switching from in-person to online instruction on course final grades in an introductory economics class (Alpert, Couch and Harmon 2014; Joyce et al. 2014). Additionally, we recently conducted a resume audit experiment and found that employers are less likely to contact otherwise-identical fictitious job applicants when they have business degrees from online for-profit institutions as compared to degrees from non-selective public institutions (Deming et al. 2014). It will be interesting to see how online degrees from flagship public universities are viewed by the labor market, especially if the online campus degree and transcript are designed to be indistinguishable from the in-person versions.[8]

Second, the general equilibrium effects of online education deserve further study but are beyond the scope of this paper. Online learning technologies may exert competitive pressure on the entire postsecondary education sector, lowering prices and/or increasing efficiency. The rapid growth of online for-profit education during the past decade and the recent entry of flagship public universities into the sector suggest that the competition for online students in higher education has only just begun.

[8] The Penn State – World Campus website prominently displays the following message: "As a World Campus graduate, you will earn your degree from The Pennsylvania State University. Diplomas and transcripts are identical to those earned by our Penn State students studying on campus."

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TABLE 1—ENROLLMENT IN ONLINE COURSES BY UNDERGRADUATE, DEGREE-SEEKING U.S. STUDENTS, 2013

	All Students				Students Enrolled in All Online Courses			
	All Online (1)	Some Online (2)	No Online (3)	Total (000) (4)	In State (5)	Out of State (6)	Outside U.S. (7)	Total (000) (8)
Public 4-year, selective	0.015	0.139	0.845	2,061	0.820	0.103	0.003	32.6
Private not-for-profit 4-year, selective	0.010	0.030	0.961	1,110	0.610	0.358	0.024	10.8
Public 4-year, not selective	0.074	0.192	0.734	4,335	0.781	0.175	0.014	320.8
Public 2-year, not selective	0.095	0.199	0.706	5,630	0.917	0.045	0.006	534.7
Private not-for-profit 2-year, not selective	0.176	0.112	0.708	1,679	0.333	0.625	0.009	294.9
For-profit, independent	0.085	0.064	0.535	487	0.329	0.663	0.007	41.3
For-profit, chain	0.542	0.076	0.370	1,074	0.131	0.784	0.012	582.4
Total	0.111	0.157	0.720	16,376	0.529	0.416	0.010	1,816.6

Notes: Selective institutions have a rating of "very competitive" or higher due to the 2009 Barron's college selectivity ratings. For-profit "chains" are defined as institutions (grouped by brand name, e.g. University of Phoenix) that operate in multiple states, following Deming, Goldin and Katz (2012). "All online" defined as the share of undergraduate degree-seeking students enrolled "exclusively" in distance education courses. "Some Online" defined as enrollment in at least one (but not all) distance education course. The sample is restricted to Title IV eligible postsecondary institutions. Columns (1) through (3) do not sum to 100 percent because some institutions do not report online enrollment. Columns (5) through (7) do not sum to 100 percent because the omitted category is "Unknown/Not Reported."

Source: U.S. Department of Education, NCES, Integrated Postsecondary Education Data System (IPEDS).

TABLE 2—ARE PRICES LOWER WHEN MORE STUDENTS ARE ENROLLED ONLINE?

Outcome is the natural log of tuition and fees	Public			Private For-profit or Not-for-profit		
	(1)	(2)	(3)	(4)	(5)	(6)
Share taking all courses online	-0.453**	-0.184*	-0.135*	-0.151**	-0.147**	-0.034
	(0.080)	(0.092)	(0.063)	(0.028)	(0.033)	(0.036)
Share taking some (not all) courses online	-0.100	-0.069	0.019	-0.020	0.033	0.058
	(0.061)	(0.099)	(0.065)	(0.047)	(0.045)	(0.069)
Observations	3,186	3,186	3,186	3,099	3,099	3,099
Covariates	yes	yes	yes	yes	yes	yes
CBSA fixed effects		yes			yes	
Institution-year fixed effects			yes			yes

Notes: Each column reports results from a regression of the natural log of published tuition and fees for full-time enrolled students on year fixed effects, the natural log of enrollment, controls for sector, highest degree offered, urbanicity, selectivity as measured by the 2009 Barron's rankings, a series of admissions criteria reported by the school (e.g., whether they are open admission, accepting SAT scores, college essays) and (when reported) 25th and 7th percentile ACT and SAT scores in each major subject. We set missing values for the listed covariates equal to zero and include an indicator for whether each variable is missing. Columns (2) and (5) include fixed effects for Core-Based Statistical Area (CBSA), with "no CBSA" as the absorbing category. Columns (3) and (6) include fixed effects for each institution-year. The unit of observation is a campus-year cell. Since IPEDS data are collected at the campus level, the results in columns (3) and (6) compare prices to online enrollment shares across branches of the same institution (e.g. regional campuses of a state college or university). The sample includes data from 2012 and 2013 and is restricted to degree-seeking undergraduates in Title IV-eligible U.S. postsecondary institutions. We use in-state tuition for public institutions.

** Significant at the 1% level.
* Significant at the 5% level.

Source: U.S. Department of Education, NCES, Integrated Postsecondary Education Data System (IPEDS).

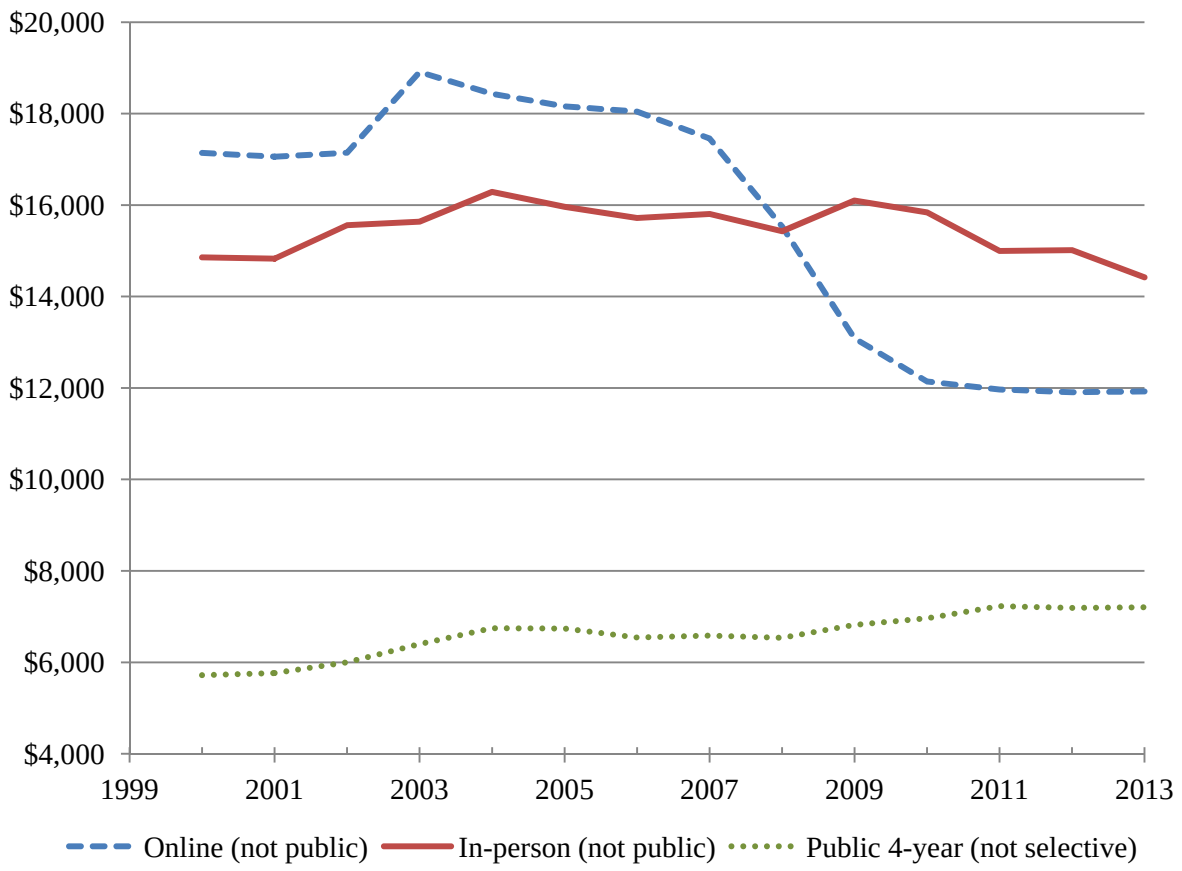

FIGURE 1. TRENDS IN TUITION BY INSTITUTION TYPE

Notes: Online schools are defined as those that enrolled more than 50 percent of students in "exclusively" distance education in 2012, the first year that online enrollment data were collected at the institution level. "Not public" means for-profit and not-for-profit campuses. "Not selective" excludes schools rated "Very Competitive" or higher in the 2009 Barron's college rankings. Schools are tracked over time using the IPEDS campus identifier (the "unitid"). Each series is weighted by current-year enrollment. Tuition is reported in 2014 dollars.